

ENSO: Recent Evolution, Current Status and Predictions



Update prepared by:
Climate Prediction Center / NCEP
3 December 2018

Outline

Summary

Recent Evolution and Current Conditions

Oceanic Niño Index (ONI)

Pacific SST Outlook

U.S. Seasonal Precipitation and Temperature Outlooks

Summary

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ENSO Alert System Status: El Niño Watch

ENSO-neutral conditions are present.*

Equatorial sea surface temperatures (SSTs) are above average across most of the Pacific Ocean.

El Niño is expected to form and continue through the Northern Hemisphere winter 2018-19 (~80% chance) and into spring (55-60% chance).*

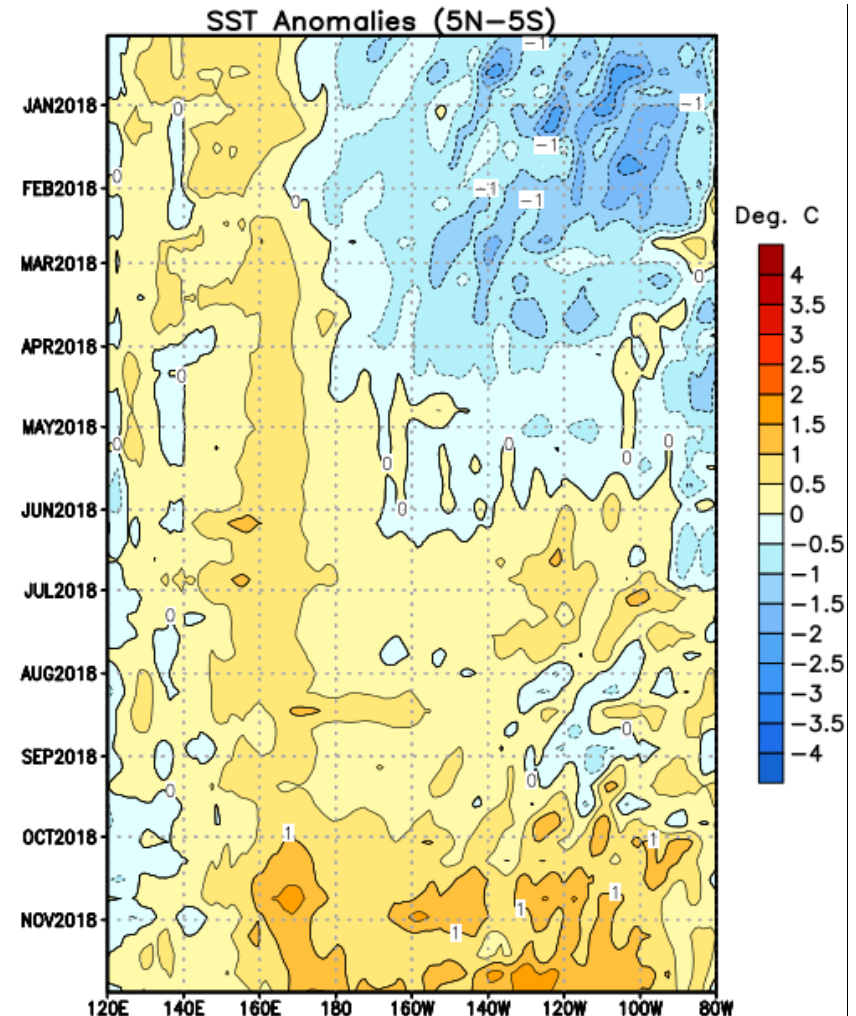
* Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking [here](#).

Recent Evolution of Equatorial Pacific SST Departures (°C)

From September 2017 to late March 2018, below-average SSTs persisted across the central and eastern Pacific Ocean.

Since early June, near-to-above average SSTs have been present across most of the Pacific Ocean.

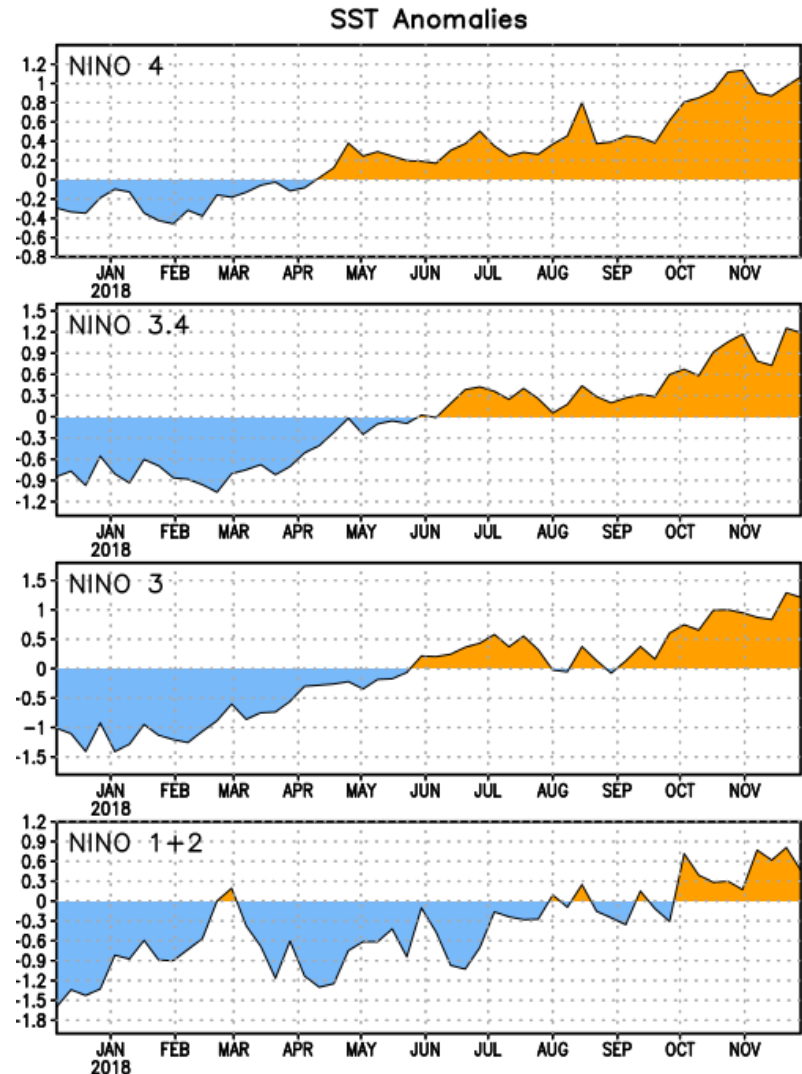
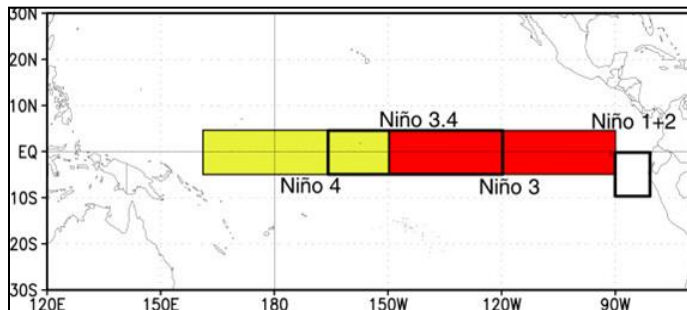
In the last couple of weeks, positive SST anomalies have strengthened across most of the equatorial Pacific.



Niño Region SST Departures (°C) Recent Evolution

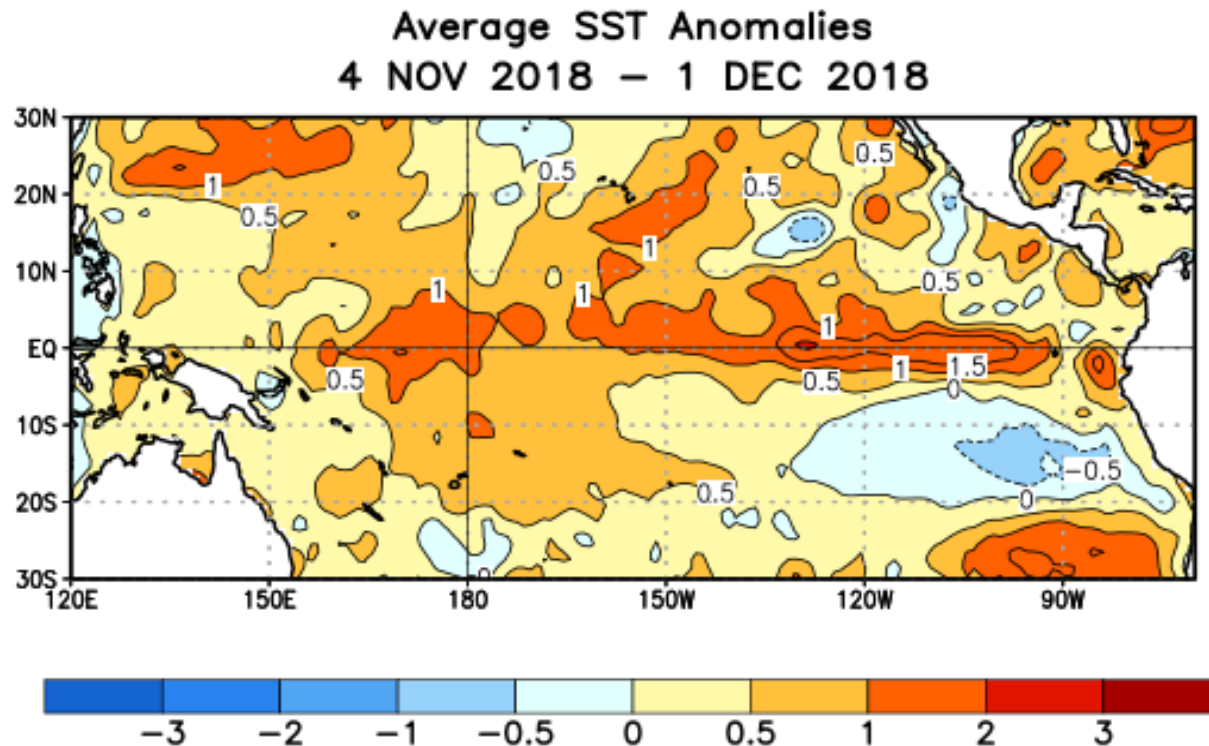
The latest weekly SST departures are:

Niño 4	1.1°C
Niño 3.4	1.2°C
Niño 3	1.2°C
Niño 1+2	0.5°C



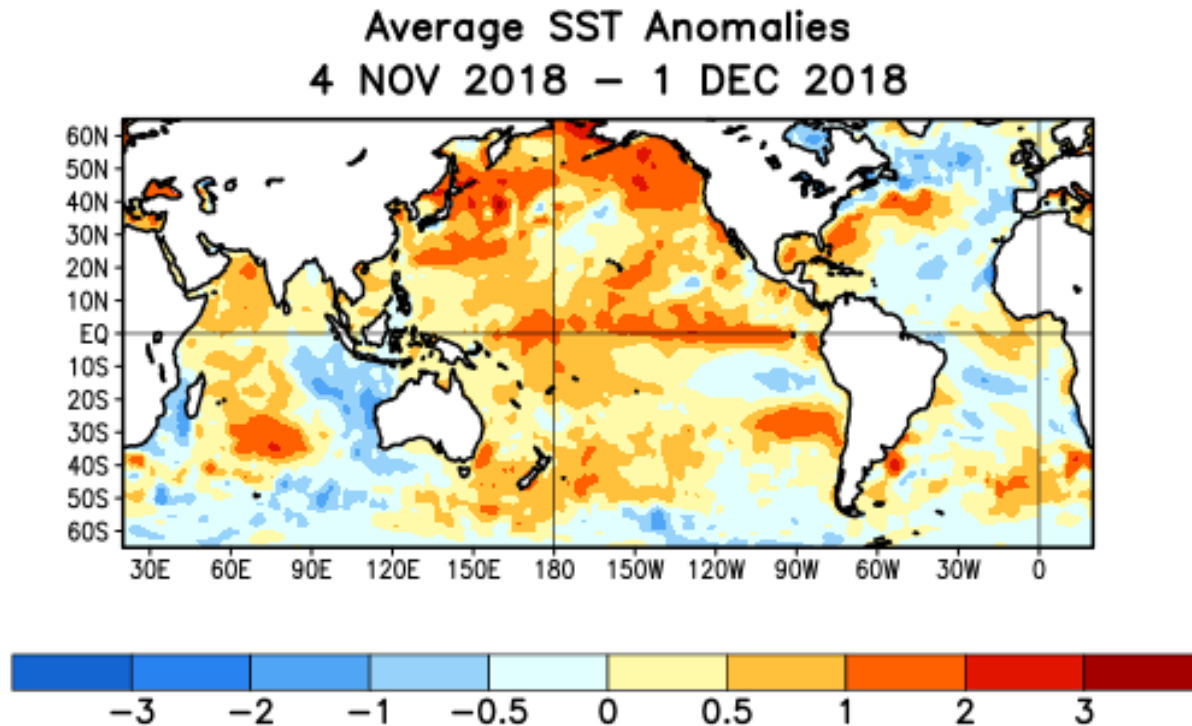
SST Departures ($^{\circ}\text{C}$) in the Tropical Pacific During the Last Four Weeks

During the last four weeks, equatorial SSTs were above average across the Pacific Ocean.



Global SST Departures (°C) During the Last Four Weeks

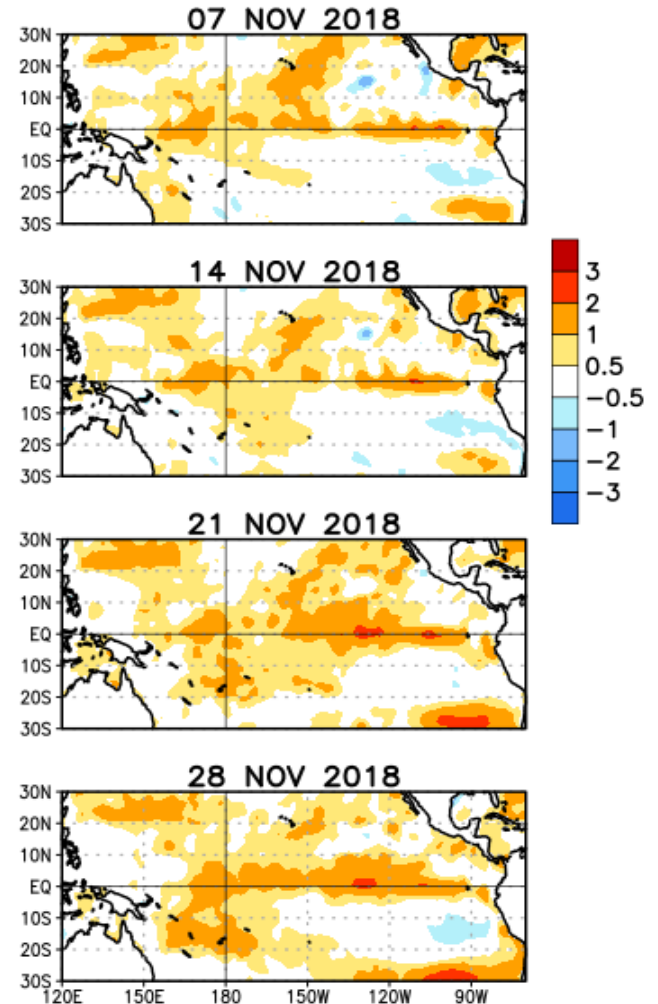
During the last four weeks, equatorial SSTs were above average across the Pacific Ocean and the eastern Atlantic Ocean. SSTs were below average near Indonesia and in the eastern Indian Ocean.



Weekly SST Departures during the Last Four Weeks

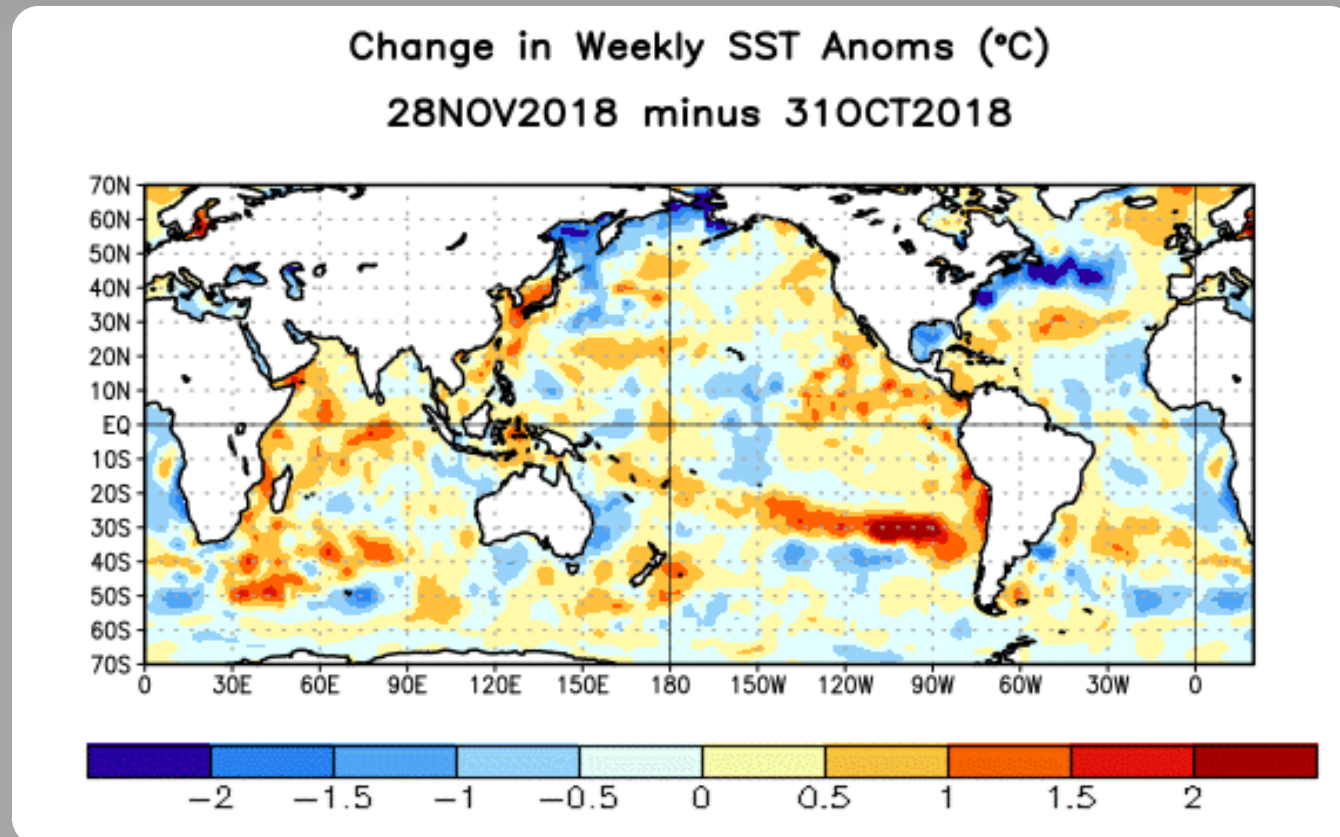
During the last four weeks, above-average SSTs strengthened across the equatorial Pacific Ocean.

Weekly SST Anomalies (DEG C)



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, positive changes were observed across the eastern equatorial Pacific Ocean.



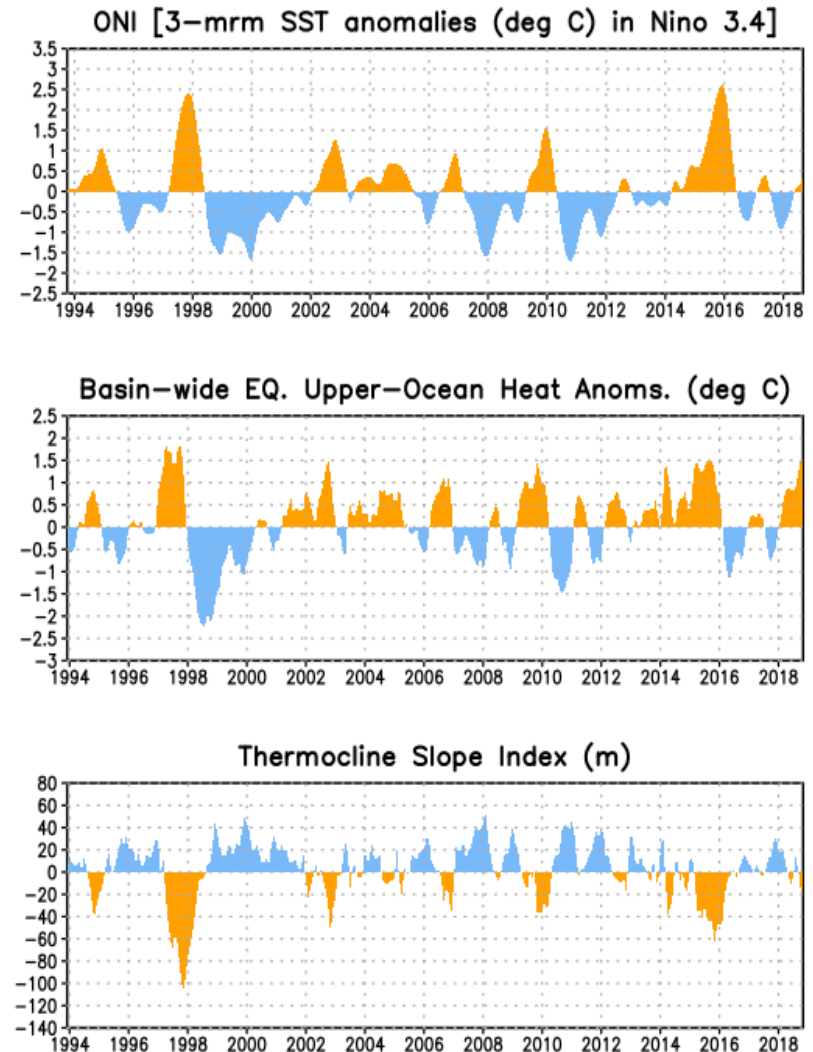
Upper-Ocean Conditions in the Equatorial Pacific

The basin-wide equatorial upper ocean (0-300 m) heat content is greatest prior to and during the early stages of a Pacific warm (El Niño) episode (compare top 2 panels), and least prior to and during the early stages of a cold (La Niña) episode.

The slope of the oceanic thermocline is least (greatest) during warm (cold) episodes.

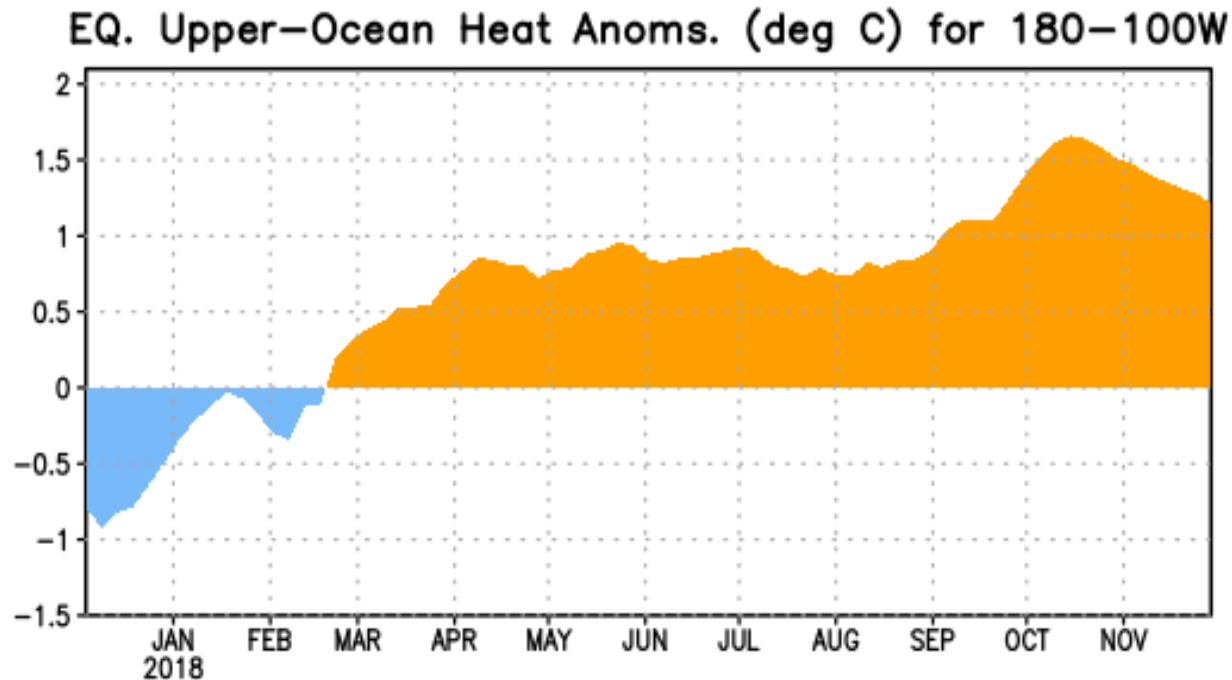
Recent values of the upper-ocean heat anomalies (above average) and thermocline slope index (near average) reflect the trend toward El Niño conditions.

The monthly thermocline slope index represents the difference in anomalous depth of the 20°C isotherm between the western Pacific (160°E-150°W) and the eastern Pacific (90°-140°W).



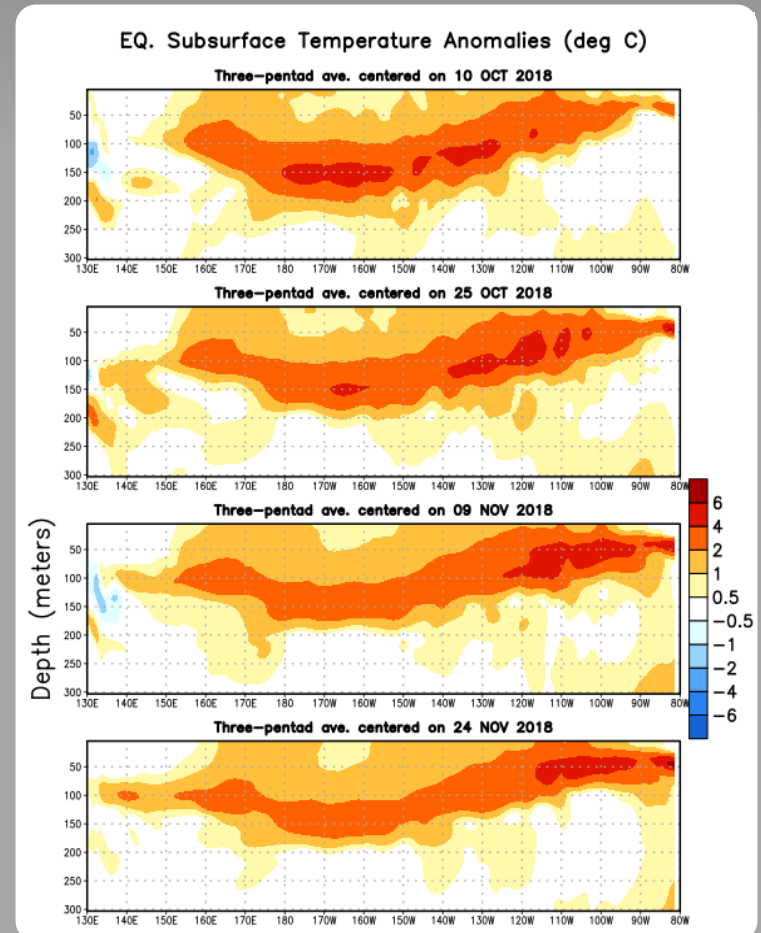
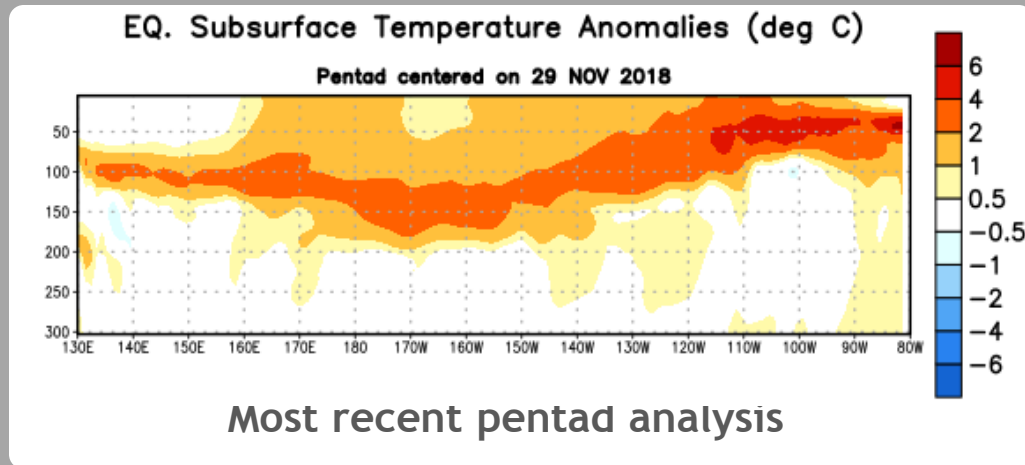
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Negative subsurface temperature anomalies lasted until February 2018. Since the end of February, temperature anomalies increased and have been positive. From September to early October, positive anomalies increased. Since late October, positive anomalies have decreased.



Sub-Surface Temperature Departures in the Equatorial Pacific

In the last two months, positive subsurface temperature anomalies have persisted throughout the equatorial Pacific Ocean.

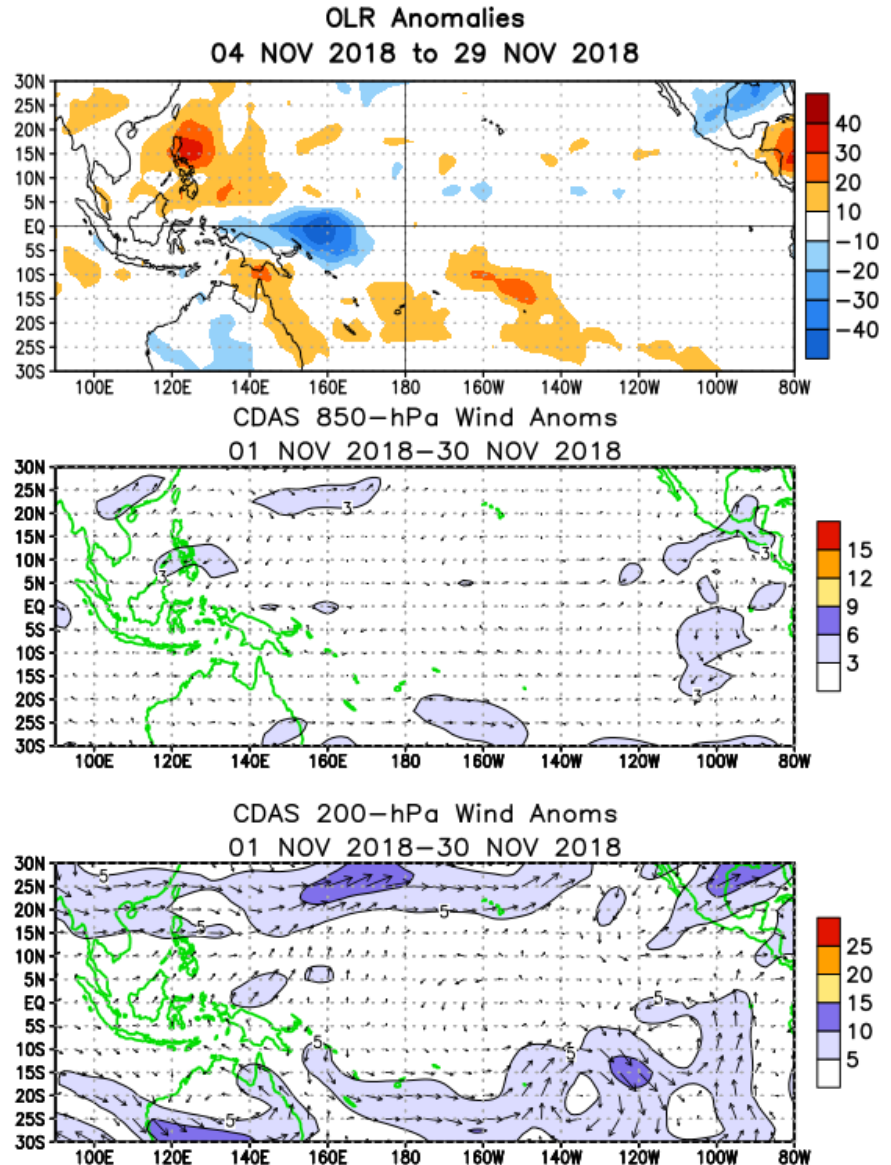


Tropical OLR and Wind Anomalies During the Last 30 Days

Positive OLR anomalies (suppressed convection and precipitation) were evident over the Philippines. Negative OLR anomalies were observed in the western Pacific.

Low-level (850-hPa) winds were mostly near average across the equatorial Pacific.

Anomalous upper-level (200-hPa) cross-equatorial winds were observed over the eastern Pacific.



Intraseasonal Variability

Intraseasonal variability in the atmosphere (wind and pressure), which is often related to the Madden-Julian Oscillation (MJO), can significantly impact surface and subsurface conditions across the Pacific Ocean.

Related to this activity:

Significant weakening of the low-level easterly winds usually initiates an eastward-propagating oceanic Kelvin wave.

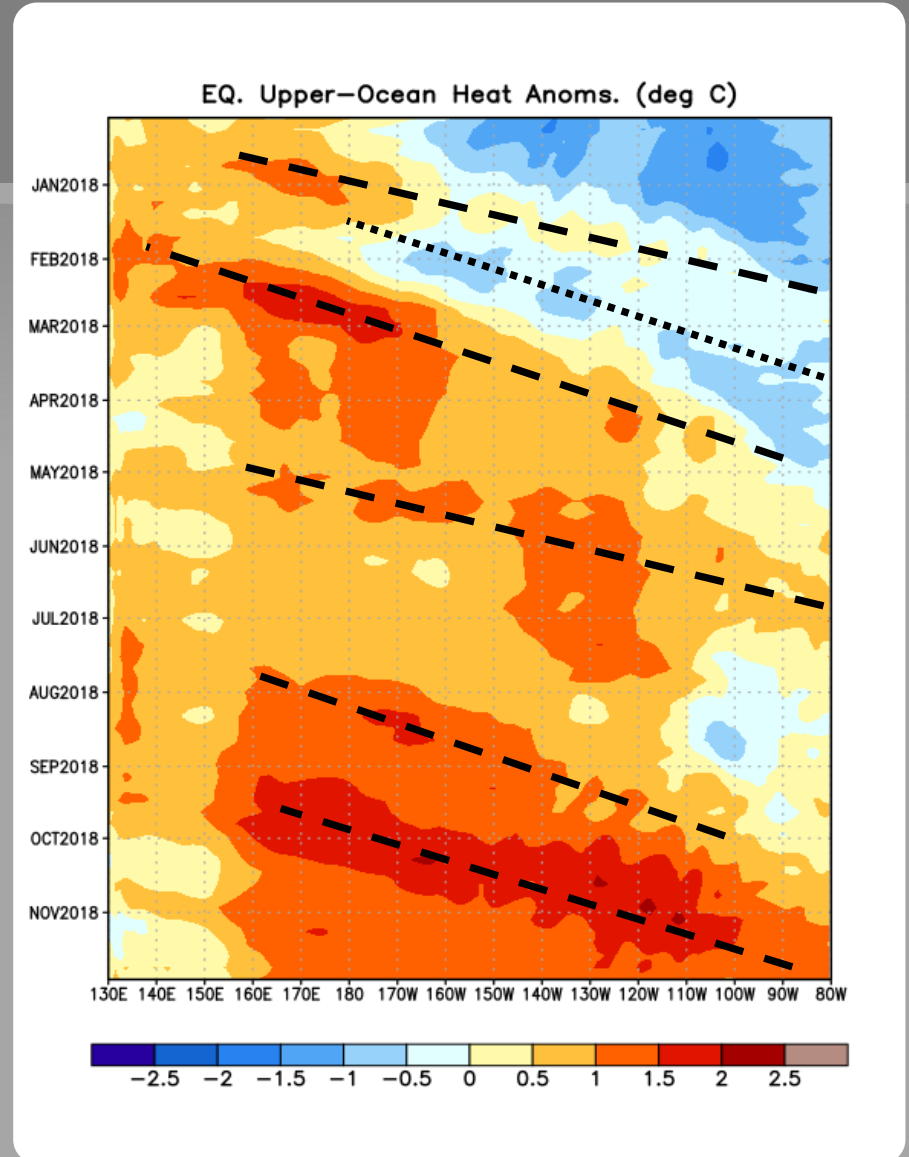
Weekly Heat Content Evolution in the Equatorial Pacific

From December 2017- May 2018, successive Kelvin waves contributed to the eastward shift of positive and negative subsurface temperature anomalies.

During July-August 2018, positive subsurface temperature anomalies weakened in the eastern Pacific.

In early August and again in October and November 2018, positive subsurface anomalies increased, partly due to downwelling Kelvin waves.

Equatorial oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Downwelling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.



Low-level (850-hPa) Zonal (east-west) Wind Anomalies (m s^{-1})

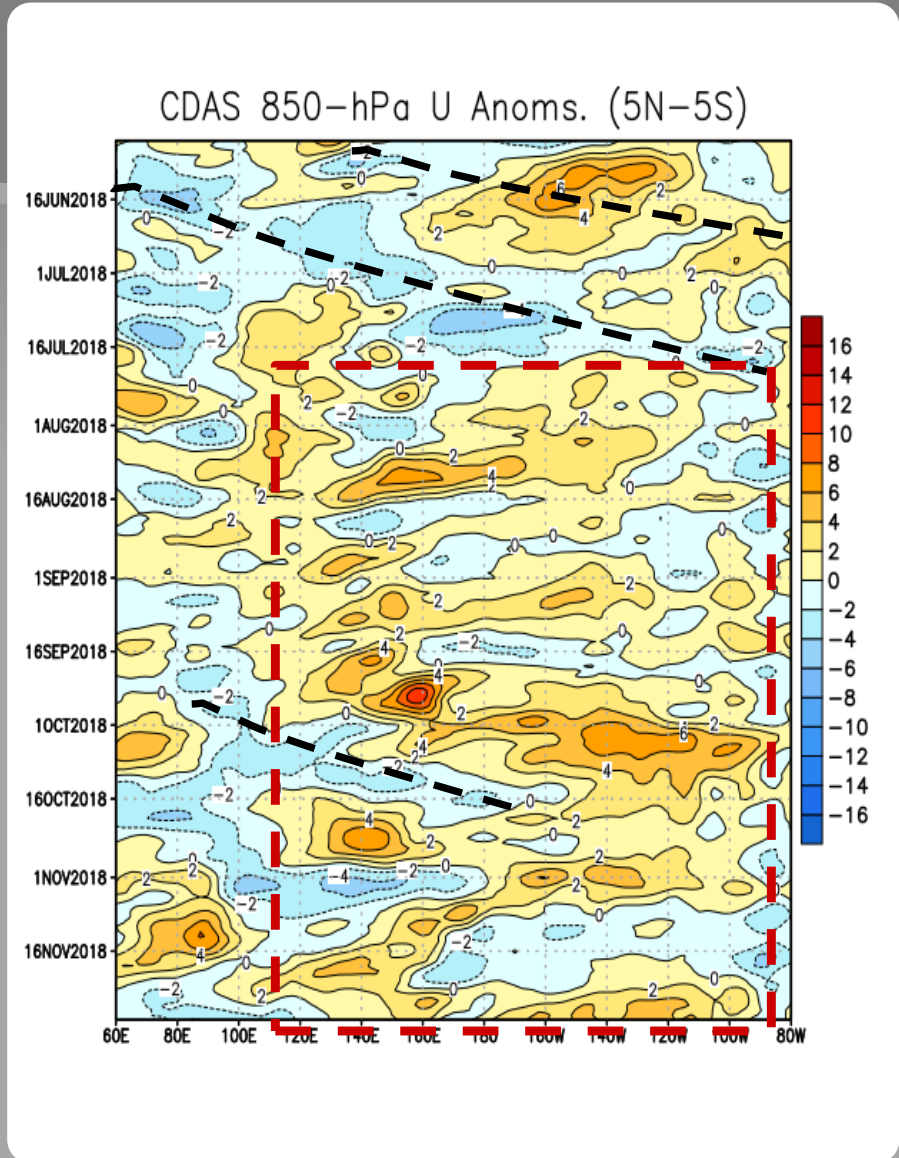
At times, the Madden Julian Oscillation (MJO) contributed to the eastward propagation of low-level wind anomalies.

Since mid-July, westerly wind anomalies have become more prevalent over the equatorial Pacific Ocean.

Recently, westerly wind anomalies returned across most of the equatorial Pacific.

Westerly Wind Anomalies (orange/red shading)

Easterly Wind Anomalies (blue shading)



Upper-level (200-hPa) Velocity Potential Anomalies

Through June 2018, anomalous upper-level convergence (brown shading) persisted over the central Pacific.

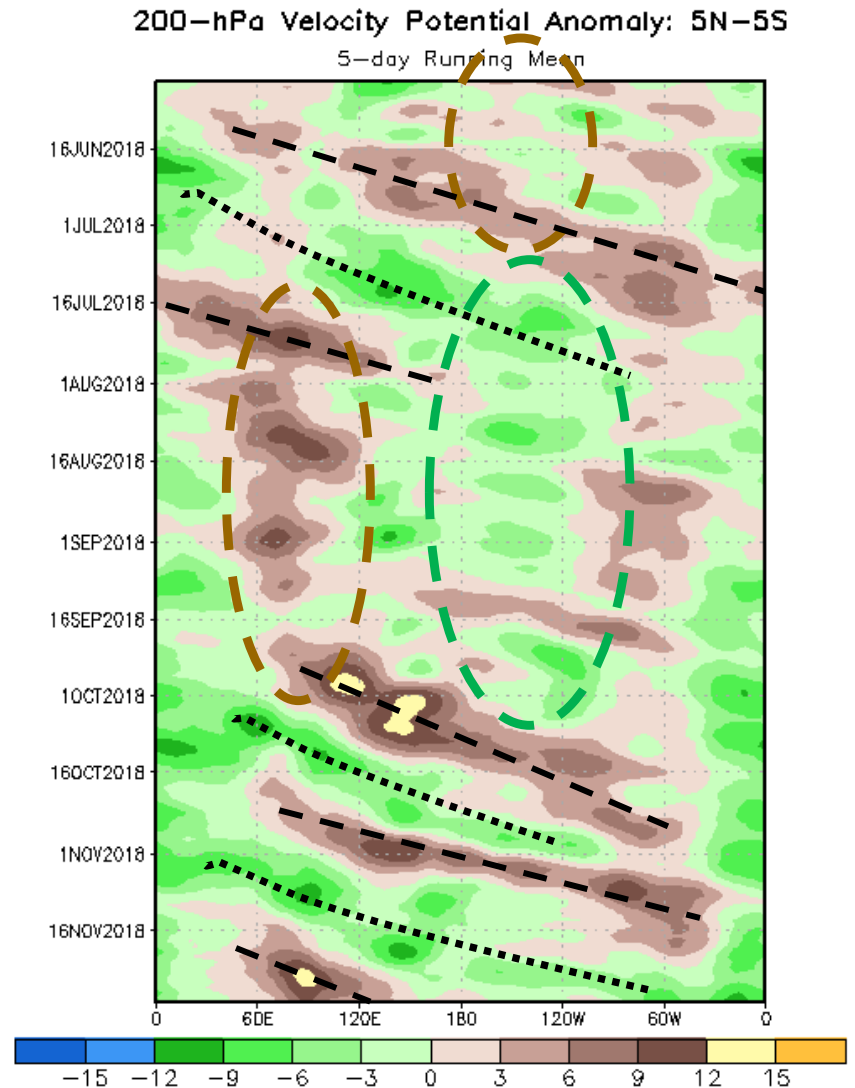
Since early July 2018, anomalous upper-level convergence has mostly persisted over the Indian Ocean, while anomalous upper-level divergence (green shading) has mostly persisted over the central and east-central Pacific.

Recently, anomalous upper-level convergence has emerged near the Indian Ocean/Indonesia.

Unfavorable for precipitation (brown shading)

Favorable for precipitation (green shading)

Note: Eastward propagation is not necessarily indicative of the Madden-Julian Oscillation (MJO).

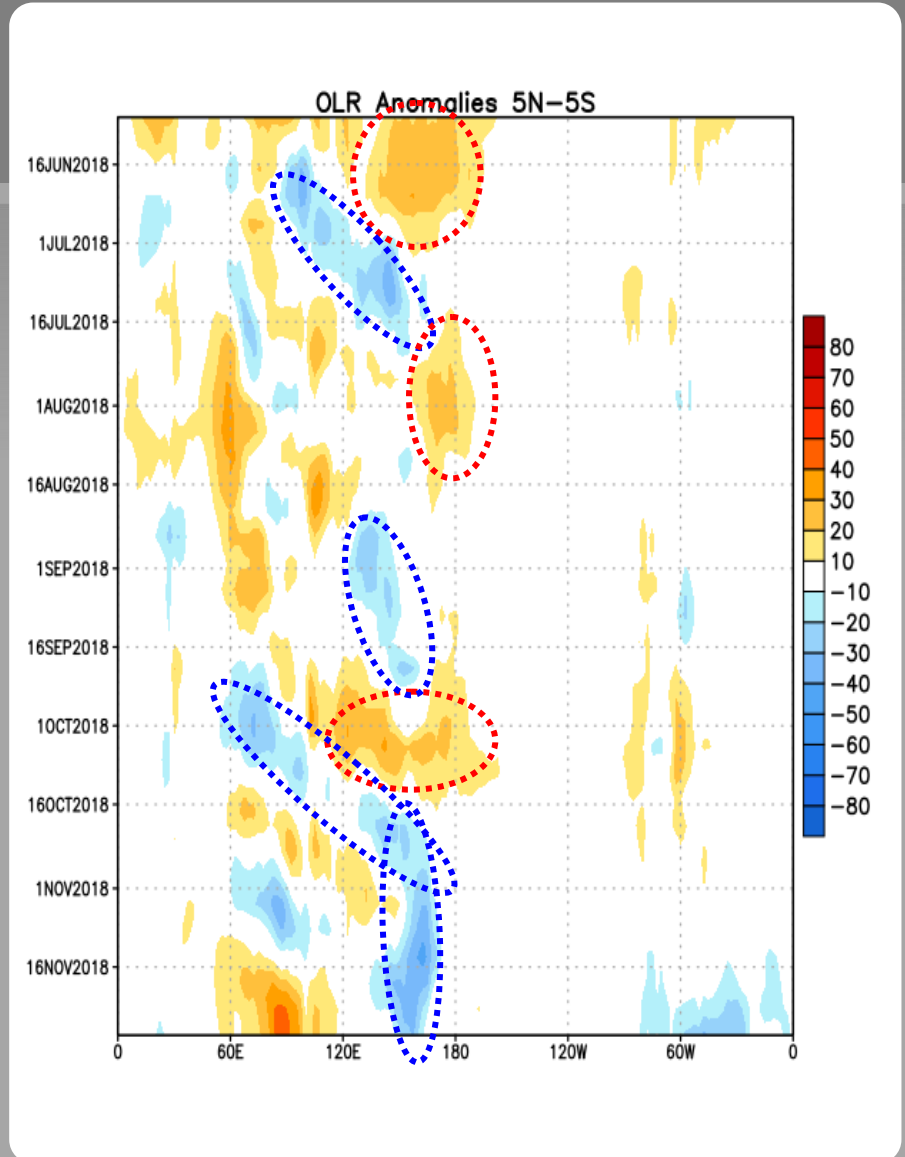


Outgoing Longwave Radiation (OLR) Anomalies

Through June 2018 and from mid-July to mid-August, positive OLR anomalies persisted over the central Pacific Ocean.

Since mid-October 2018, negative OLR anomalies have persisted over the western Pacific.

Drier-than-average Conditions (orange/red shading)
Wetter-than-average Conditions (blue shading)



Oceanic Niño Index (ONI)

The ONI is based on SST departures from average in the Niño 3.4 region, and is a principal measure for monitoring, assessing, and predicting ENSO.

Defined as the three-month running-mean SST departures in the Niño 3.4 region. Departures are based on a set of improved homogeneous historical SST analyses (Extended Reconstructed SST - ERSST.v5). The SST reconstruction methodology is described in Huang et al., 2017, J. Climate, vol. 30, 8179-8205.)

It is one index that helps to place current events into a historical perspective

NOAA Operational Definitions for El Niño and La Niña

El Niño: characterized by a positive ONI greater than or equal to $+0.5^{\circ}\text{C}$.

La Niña: characterized by a negative ONI less than or equal to -0.5°C .

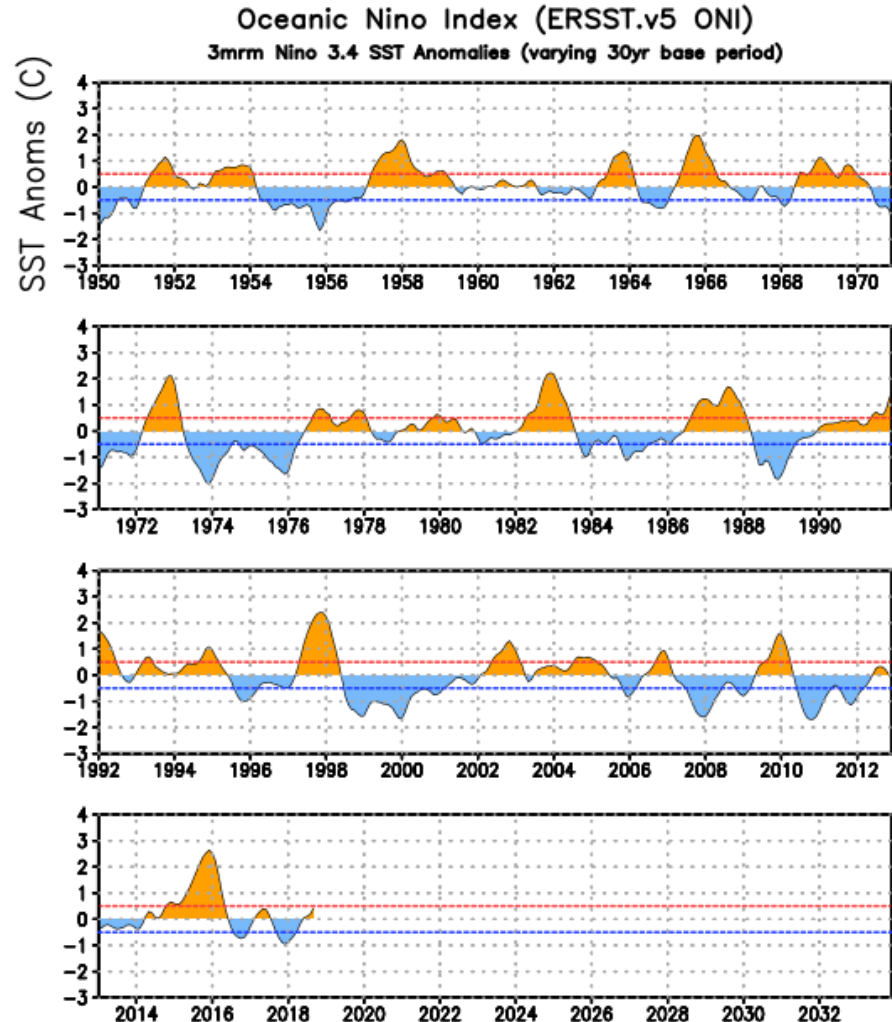
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

CPC considers El Niño or La Niña conditions to occur when the monthly Niño3.4 OISST departures meet or exceed $\pm 0.5^{\circ}\text{C}$ along with consistent atmospheric features. These anomalies must also be forecasted to persist for 3 consecutive months.

ONI (°C): Evolution since 1950

The most recent ONI value (August - October 2018) is +0.4°C.

El Niño ↑
Neutral
La Niña ↓



Historical El Niño and La Niña Episodes Based on the ONI computed using ERSST.v5

Recent Pacific warm (red) and cold (blue) periods based on a threshold of ± 0.5 °C for the Oceanic Nino Index (ONI) [3 month running mean of ERSST.v5 SST anomalies in the Nino 3.4 region (5N-5S, 120-170W)]. For historical purposes, periods of below and above normal SSTs are colored in blue and red when the threshold is met for a minimum of 5 consecutive over-lapping seasons.

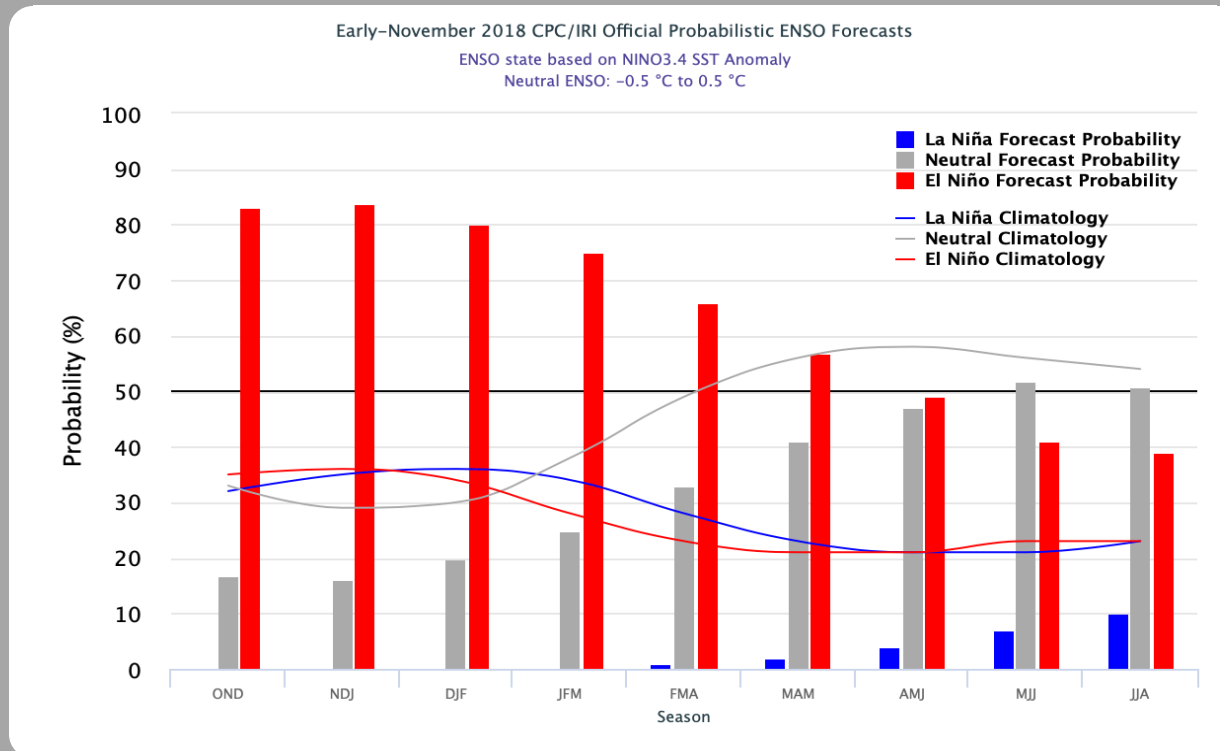
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found [here](#).

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2006	-0.8	-0.7	-0.5	-0.3	0.0	0.0	0.1	0.3	0.5	0.7	0.9	0.9
2007	0.7	0.3	0.0	-0.2	-0.3	-0.4	-0.5	-0.8	-1.1	-1.4	-1.5	-1.6
2008	-1.6	-1.4	-1.2	-0.9	-0.8	-0.5	-0.4	-0.3	-0.3	-0.4	-0.6	-0.7
2009	-0.8	-0.7	-0.5	-0.2	0.1	0.4	0.5	0.5	0.7	1.0	1.3	1.6
2010	1.5	1.3	0.9	0.4	-0.1	-0.6	-1.0	-1.4	-1.6	-1.7	-1.7	-1.6
2011	-1.4	-1.1	-0.8	-0.6	-0.5	-0.4	-0.5	-0.7	-0.9	-1.1	-1.1	-1.0
2012	-0.8	-0.6	-0.5	-0.4	-0.2	0.1	0.3	0.3	0.3	0.2	0.0	-0.2
2013	-0.4	-0.3	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.3	-0.2	-0.2	-0.3
2014	-0.4	-0.4	-0.2	0.1	0.3	0.2	0.1	0.0	0.2	0.4	0.6	0.7
2015	0.6	0.6	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.5	2.6
2016	2.5	2.2	1.7	1.0	0.5	0.0	-0.3	-0.6	-0.7	-0.7	-0.7	-0.6
2017	-0.3	-0.1	0.1	0.3	0.4	0.4	0.2	-0.1	-0.4	-0.7	-0.9	-1.0
2018	-0.9	-0.8	-0.6	-0.4	-0.1	0.1	0.1	0.2	0.4			

CPC/IRI Probabilistic ENSO Outlook

Updated: 8 November 2018

El Niño is expected to form and continue through the Northern Hemisphere winter 2018-19 (~80% chance) and into spring (55-60% chance).



IRI/CPC Pacific Niño

3.4 SST Model Outlook

The majority of models predict El Niño to develop and persist through at least Northern Hemisphere spring 2019.

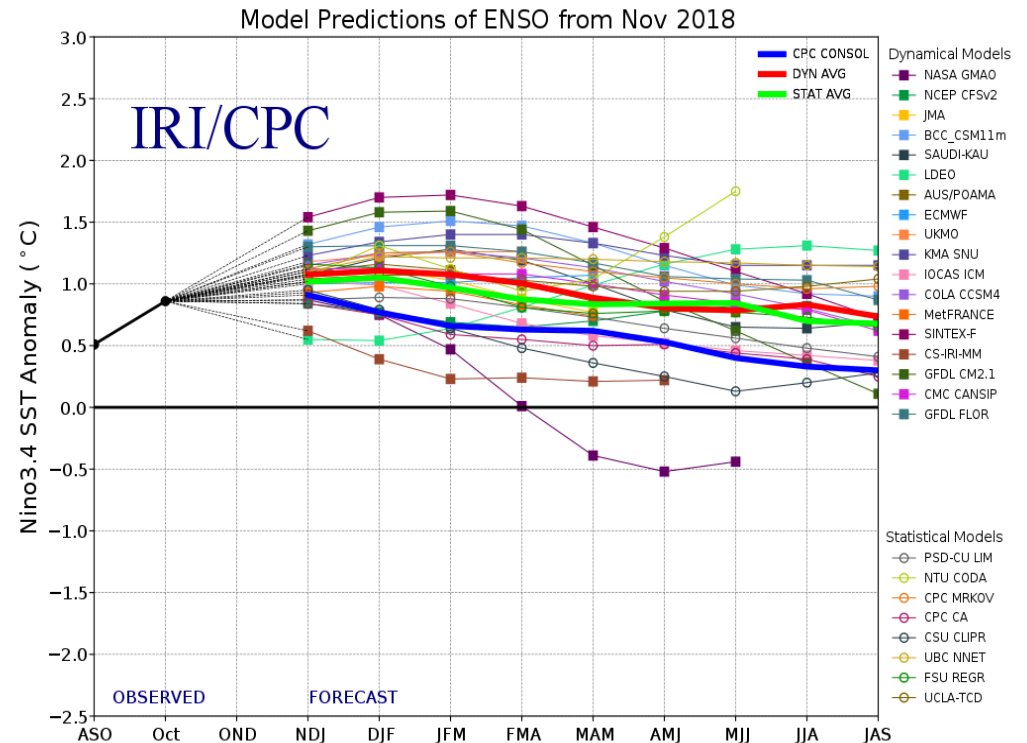


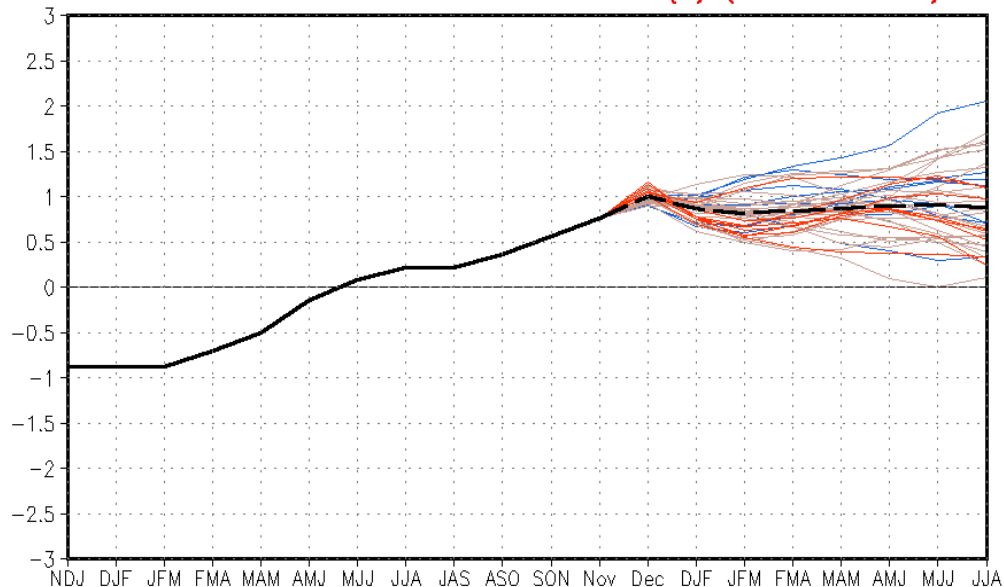
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 November 2018).

SST Outlook: NCEP CFS.v2 Forecast (PDF corrected)

Issued: 2 December 2018

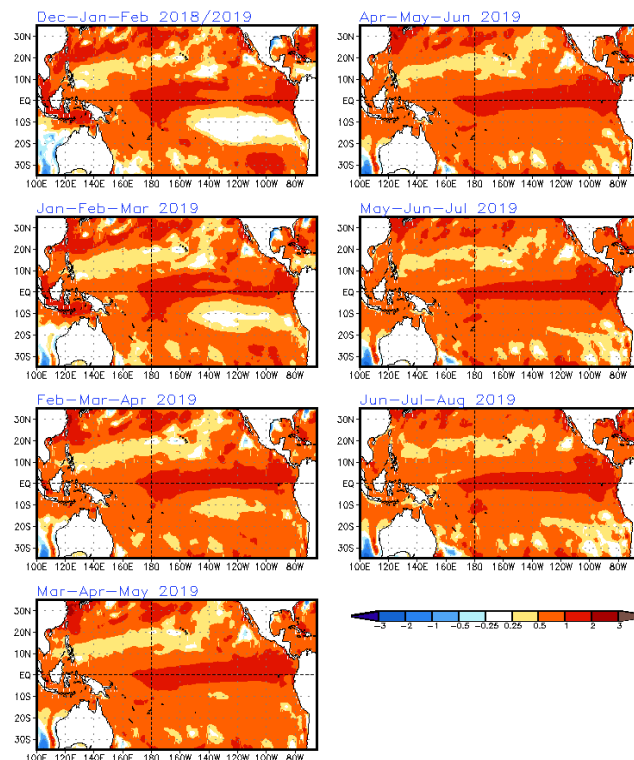
The CFS.v2 ensemble mean (black dashed line) predicts El Niño through at least the Northern Hemisphere spring 2019.

CFSv2 forecast Nino3.4 SST anomalies (K) (PDF corrected)



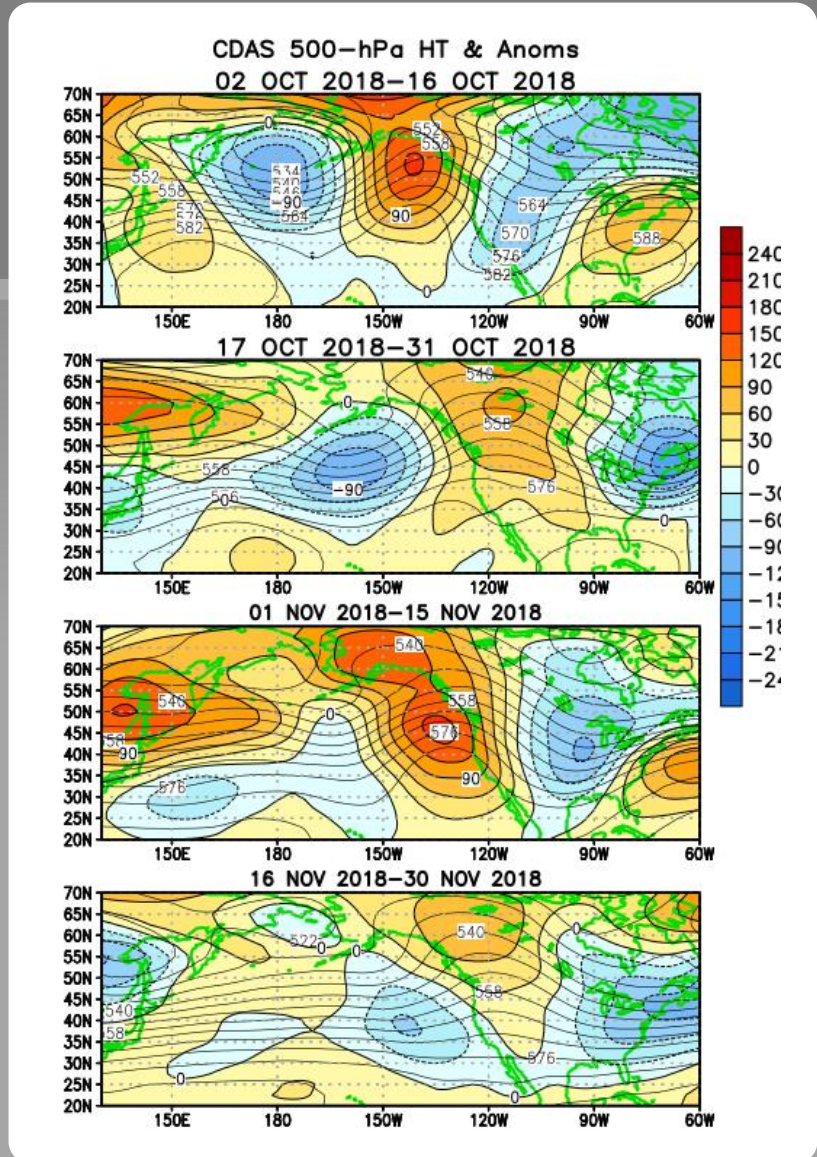
— Latest 8 forecast members
— Earliest 8 forecast members
— Other forecast members
— Forecast ensemble mean
— NCDC daily analysis

(Model bias correct base period: 1999–2010; Climatology base period: 1982–2010)



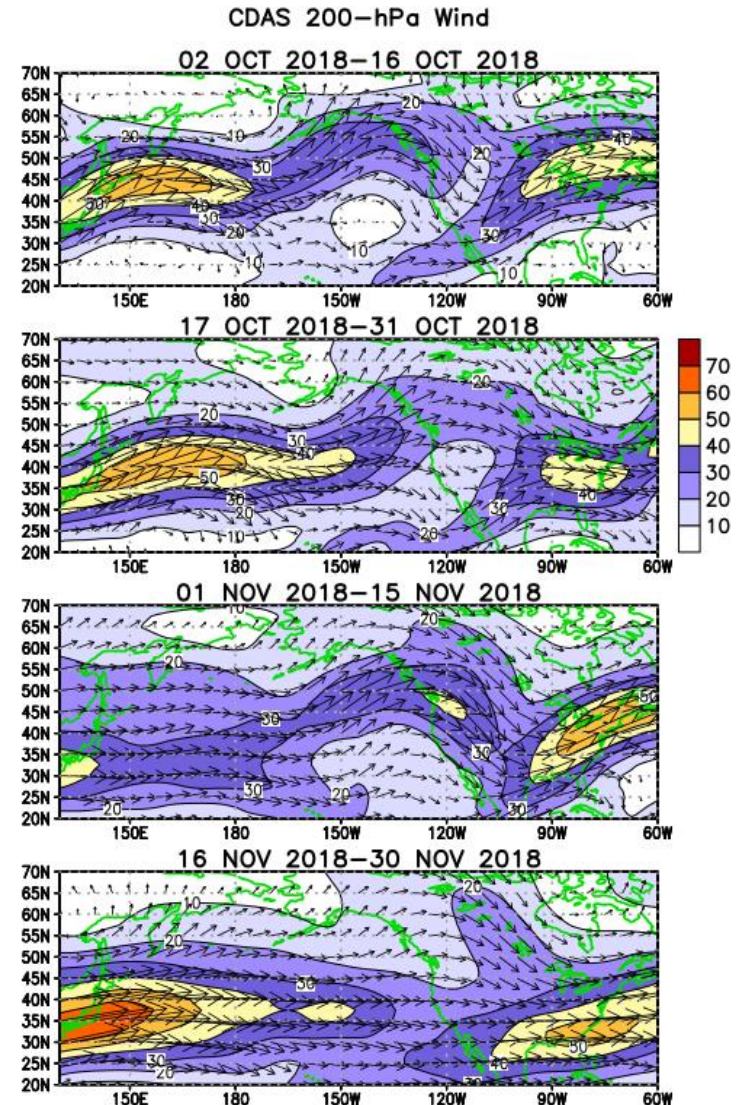
Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

Since mid October, the pattern has been mostly characterized by anomalous ridging (and above-average temperatures) over the western U.S. and anomalous troughing (and below-average temperatures) over the central and/or eastern U.S.



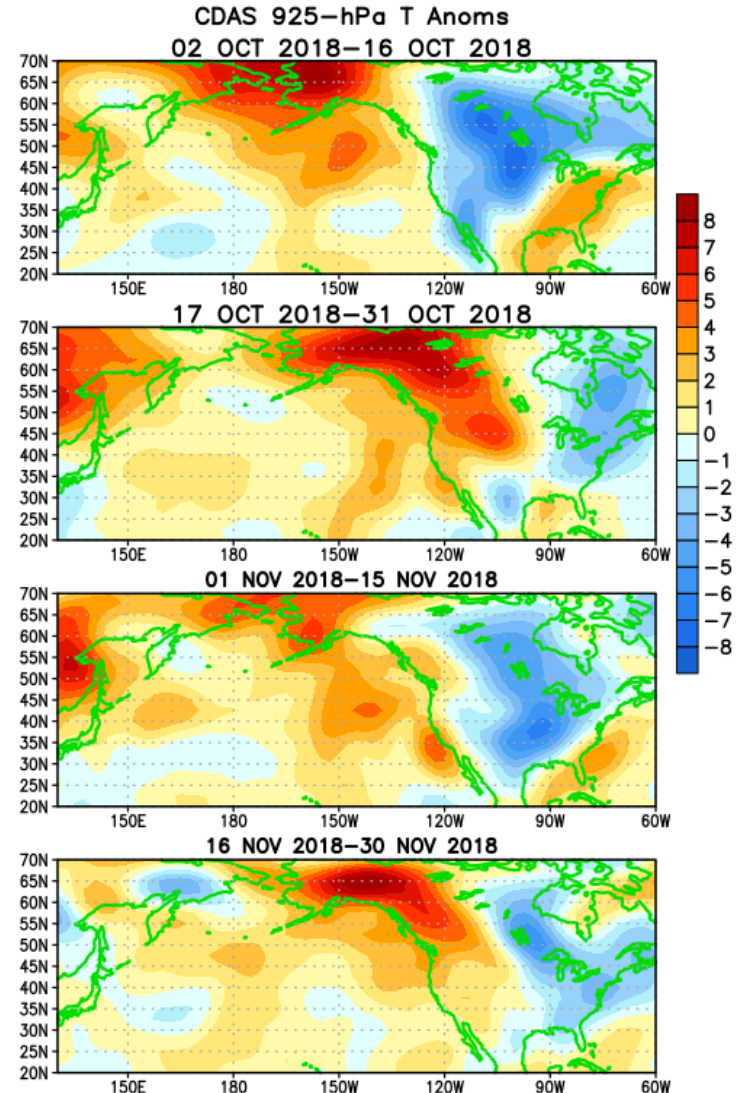
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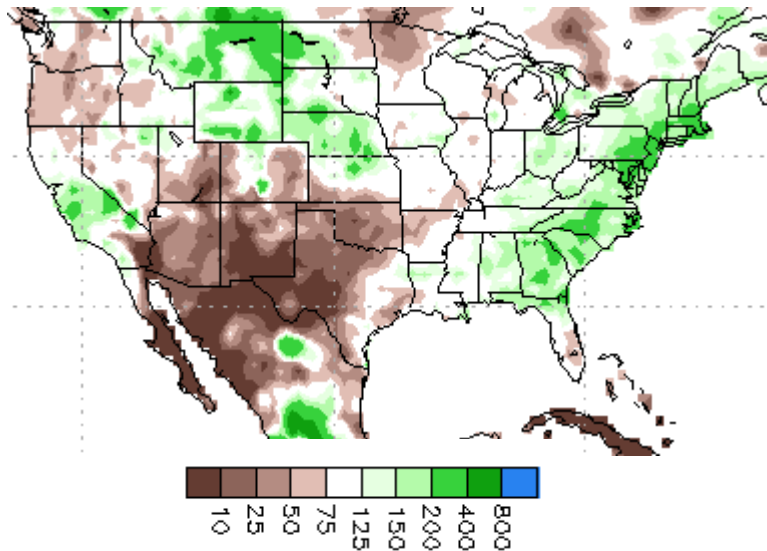
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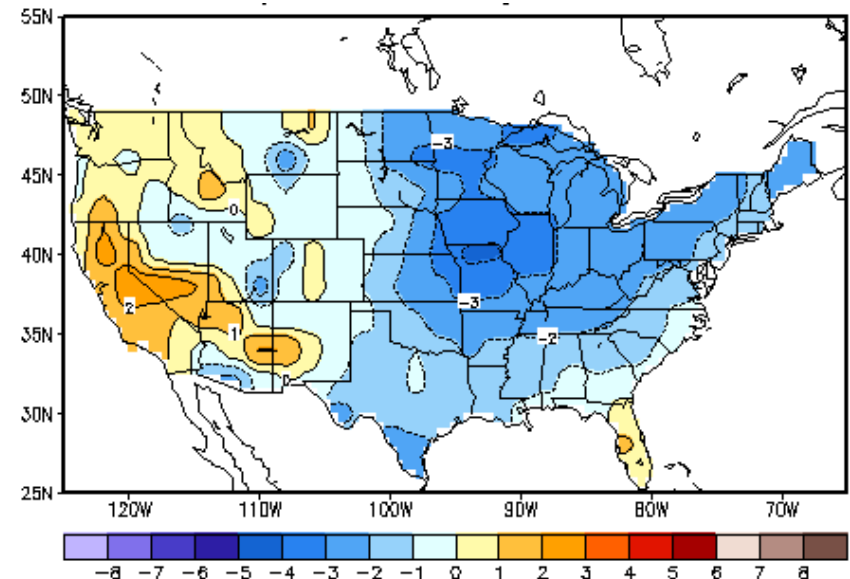
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 1 December 2018

Percent of Average Precipitation



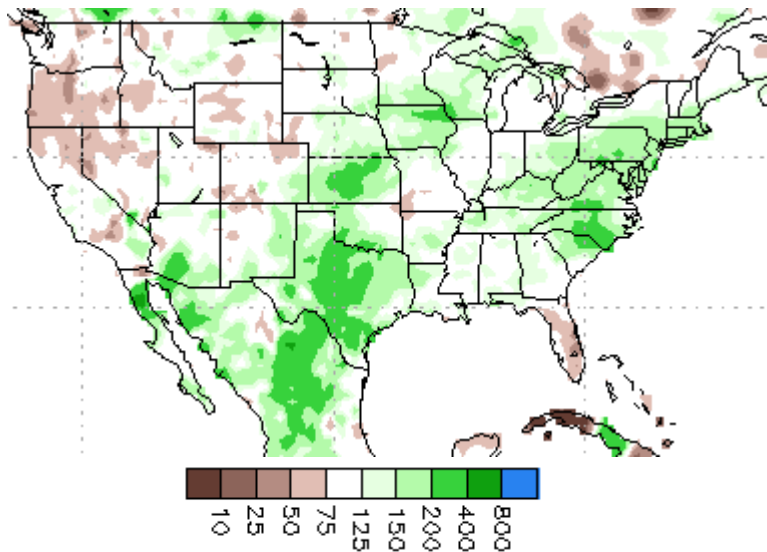
Temperature Departures (degree C)



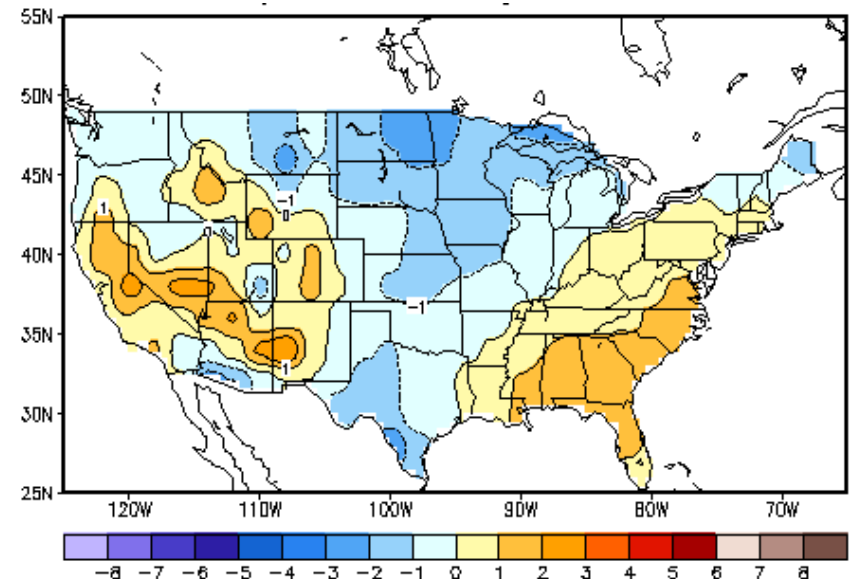
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 1 December 2018

Percent of Average Precipitation



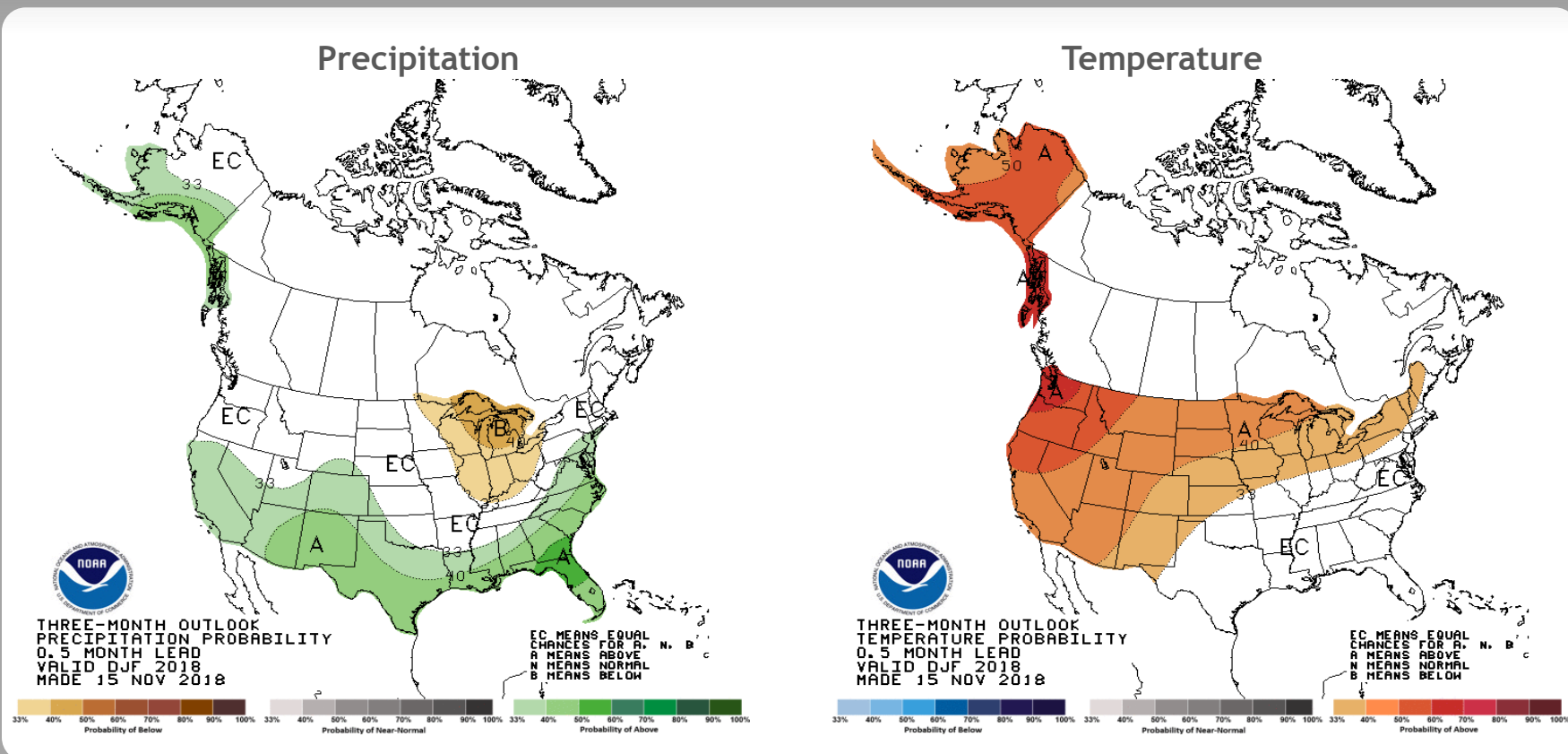
Temperature Departures (degree C)



U. S. Seasonal Outlooks

December 2018 - February 2019

The seasonal outlooks combine the effects of long-term trends, soil moisture, and, when appropriate, ENSO.



Summary

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ENSO-neutral conditions are present.*

Equatorial sea surface temperatures (SSTs) are above average across most of the Pacific Ocean.

El Niño is expected to form and continue through the Northern Hemisphere winter 2018-19 (~80% chance) and into spring (55-60% chance).*

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